

Specification for

Safety of household and similar electrical appliances —

Part 101: General requirements

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Foreword

This Part of BS 3456, having been prepared under the direction of the Light Electrical Engineering Standards Committee, supersedes BS 3456-101:1978 which is withdrawn.

To facilitate alignment with IEC Publications and CENELEC¹⁾ Harmonization Documents it has become necessary to revert to the arrangement for BS 3456 as was used in the 1966 and 1969 editions with the general requirements for all types of appliance gathered together in one Part and the particular requirements for each type of appliance published in separate Sections, which are read in conjunction with the general requirements. The publication of seventeen separate Sections of BS 3456 is in hand and these Sections when used together with this Part will specify the requirements for a wide range of appliances. These new publications will be aligned with their respective CENELEC Harmonization Documents which in turn are based on the IEC Publications.

This edition of Part 101 is an editorial re-arrangement of the 1978 edition as modified by Amendment 1. The 1978 edition was prepared as a base document for various “stand alone” product specifications for particular appliances which were published as Sections of BS 3456-3 “Complete particular specifications”.

This revision of Part 101 is the implementation in a British Standard of CENELEC Harmonization Document 251 S3 which is based on the second edition of IEC Publication 335-1, including Amendments 1 and 2. This specification may also be used as guidance in those cases where an appliance exists for which particular requirements have not yet been prepared. Particular requirements for various appliances are given in Sections of BS 3456-102.

Amendments 3, 4, 5 and 6 have been published to IEC Publication 335-1. In CENELEC a European Standard has been issued in 1988 based on IEC Publication 335-1 including Amendment 3, and it is being published in the United Kingdom as a new Part 201 of BS 3456. Amendments 1, 2 and 3 to CENELEC HD 251 S3 were implemented by an amendment to this standard.

However, this edition of Part 101 will be required for a number of years to provide the general requirements for a variety of products specified in current CENELEC Harmonization Documents. Amendments 1, 2 and 3 to CENELEC HD 251 S3 were implemented by an amendment to this standard.

CENELEC Harmonization Documents recognize certain national deviations which cannot, for the moment, be removed. Such United Kingdom departures, in accordance with CENELEC Regulations, are denoted in the text by marginal marking as shown below²⁾. Deviations for other countries may be ascertained by reference to the relevant CENELEC Harmonization Document.

The clause and subclause numbering in this standard is the same as that in the second edition of IEC Publication 335-1:1976. In the IEC Publication the tables are not numbered but they are located in the same clauses as in this British Standard. The figure numbers are the same in both standards except that Figure 17 in this standard is Figure 18 in the IEC Publication and vice versa. Appendix A and Appendix B are technically equivalent to appendices B and E of IEC Publication 335-1. The situation with regard to the other appendices that appear in IEC Publication 335-1 is as follows.

Appendix A “Thermal controls and overload releases” is Appendix D in this standard.

Appendix C “Construction of safety isolating transformers” is deleted by CENELEC HD 251 S3 and in the United Kingdom the product is specified in BS 3535.

¹⁾ IEC = International Electrotechnical Commission CENELEC = European Committee for Electrotechnical Standardization

²⁾ 

Appendix D “Alternative requirements for protected motor units” is deleted by CENELEC HD 251 S3 because the method is not applicable.

Additional subclauses introduced either by modifications in the CENELEC Harmonization Document or by United Kingdom deviations to the Harmonization Document are numbered I, II, etc.; if they are United Kingdom deviations they also have the marginal marking shown below²⁾.

Appliances complying with British Standards in the BS 3456 series are not necessarily suitable for use in premises to which the Offices, Shops and Railway Premises Act, 1963, the Factories Act, 1961 and the Health and Safety at Work, etc. Act apply.

Compliance with the Electrical Equipment (Safety) Regulations 1975 will generally be assured if appliances comply with BS 3456. For more precise details regarding the relevance of BS 3456 to the Regulations, reference should be made to the “Administrative Guidance on the Electrical Equipment (Safety) Regulations 1975 and the Electrical Equipment (Safety) (Amendment) Regulations 1976”, available from HMSO (ISBN 0 11 513 817 X).

Attention is drawn to the fact that it is possible that household appliances may need to comply with additional non-safety requirements specified in the Building Regulations and/or the Water Byelaws.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 76, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

1.1 This Part of BS 3456 specifies the general requirements for a wide range of electric heating appliances and electric motor-operated or magnetically-driven appliances for household and similar purposes.

The particular requirements for specific types of appliances are specified in the various Sections of Part 102 of BS 3456. For a given appliance, Part 101 is to be considered together with the appropriate Section, which contains clauses to supplement or modify some of the corresponding clauses in Part 101 to provide the complete requirements for each type of product.

Appliances not intended for normal household use, but which nevertheless may be a source of danger to the public, such as appliances intended to be used by lay people in shops, in light industry and on farms, are within the scope of this standard. Examples of such appliances are appliances for hairdressers, soldering irons, glue pots, sterilizers, infra-red radiation appliances, feed boilers, water pumps and lawn mowers.

So far as is practicable this standard deals with the common hazards presented by appliances which are encountered by all persons in and around the home. However, except in so far as this standard deals with electric toys, it does not in general take into account the use of appliances by young children or infirm persons without supervision; for such use additional requirements may be necessary.

This standard does not apply to the following appliances:

- a) appliances designed exclusively for industrial purposes;
- b) appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive atmosphere (dust, vapour or gas);
- c) separate motors;
- d) appliances for high frequency heating except microwave ovens;
- e) radio and television receiving appliances (covered by BS 415);
- f) appliances covered by BS 5724-1.

Gramophones and similar motor-operated appliances intended to be used in, or in combination with, sound or vision equipment are tested together with such equipment, in accordance with BS 415.

For appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary.

For appliances intended to be used in tropical countries, special requirements may be necessary.

1.2 This standard is concerned with safety and takes into account the influence on safety of components necessary to achieve a required degree of radio and television interference suppression.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

2.1 Where the terms “voltage” and “current” are used, they imply the r.m.s. values unless otherwise specified. Where the term motor is used, it includes magnetic drive units.

2.2 For the purposes of this British Standard the following definitions, with the exception of definitions **2.2.16** and **2.2.17**, apply.

Definitions **2.2.16** and **2.2.17** have been included because, although these classes of appliance are not permitted in the United Kingdom, they are referred to in corresponding International Standards.

2.2.1 rated voltage

the voltage (for three-phase supply, the voltage between phases) assigned to the appliance by the manufacturer

2.2.2 rated voltage range

the voltage range assigned to the appliance by the manufacturer, expressed by its lower and upper limits

2.2.3 working voltage

the maximum voltage to which the part under consideration can be subjected when the appliance is operating at its rated voltage and under normal conditions of use

NOTE 1 Normal conditions of use include changes of voltage within the appliance imposed by likely occurrences, such as the operation of a circuit-breaker or the failure of a lamp.

NOTE 2 When deducing the working voltage, the effect of possible transient voltages on the supply mains is ignored.

2.2.4 rated input

the input under conditions of adequate heat discharge or under normal load and at normal operating temperature assigned to the appliance by the manufacturer

2.2.5 rated current

the current assigned to the appliance by the manufacturer

NOTE If no current is assigned to the appliance, the rated current for the purpose of this standard is determined by calculation from the rated input and the rated voltage and/or by measuring the current when the appliance is operating at rated voltage under normal load and at normal operating temperature.

2.2.6**rated frequency**

the frequency assigned to the appliance by the manufacturer

2.2.7**rated frequency range**

the frequency range assigned to the appliance by the manufacturer expressed by its lower and upper limits

2.2.8**rated capacity**

for appliances with a liquid container, the quantity of liquid for which the appliance is designed

2.2.9**detachable flexible cable or cord**

a flexible cable or cord, for supply or other purposes, intended to be connected to the appliance by means of a suitable appliance coupler

2.2.10**power supply cord**

a flexible cable or cord, for supply purposes, fixed to, or assembled with, the appliance according to one of the following methods

Type X attachment. A method of attachment such that the flexible cable or cord can easily be replaced, without the aid of special purpose tools, by a flexible cable or cord not requiring any special preparation.

Type M attachment. A method of attachment such that the flexible cable or cord can easily be replaced, without the aid of special purpose tools, by a special cable or cord with, for example, a moulded-on cord guard or crimped terminations.

Type Y attachment. A method of attachment such that the flexible cable or cord can be replaced only with the aid of special purpose tools normally available only to the manufacturer or his agents.

NOTE Type Y attachments may be used either with common flexible cables or cords or with special cables or cords.

Type Z attachment. A method of attachment such that the flexible cable or cord cannot be replaced without breaking or destroying a part of the appliance.

2.2.11**no requirement****2.2.12****basic insulation**

insulation applied to live parts to provide basic protection against electric shock

NOTE Basic insulation does not necessarily include insulation used exclusively for functional purposes.

2.2.13**supplementary insulation**

independent insulation applied in addition to basic insulation, in order to ensure protection against electric shock in the event of a failure of the basic insulation

2.2.14**double insulation**

insulation comprising both basic insulation and supplementary insulation

2.2.15**reinforced insulation**

a single insulation system applied to live parts that provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in this standard

NOTE The term "insulation system" does not imply that the insulation should be one homogeneous piece. It may comprise several layers that cannot be tested singly as supplementary or basic insulation.

2.2.16**class 0 appliance**

an appliance in which protection against electric shock relies upon basic insulation; this implies that there are no means for the connection of accessible conductive parts, if any, to the protective (earthing) conductor in the fixed wiring of the installation, reliance in the event of a failure of the basic insulation being placed upon the environment

NOTE 1 Class 0 appliances have either an enclosure of insulating material which may form a part or the whole of the basic insulation, or a metal enclosure which is separated from live parts by an appropriate insulation. If an appliance with an enclosure of insulating material has provision for earthing internal parts, it is considered to be of class I or class 0I construction.

NOTE 2 Class 0 appliances may have parts with double insulation or reinforced insulation, or parts operating at safety extra-low voltage.

2.2.17**class 0I appliance**

an appliance having at least basic insulation throughout and provided with an earthing terminal, but with a power supply cord without earthing conductor and a plug without an earthing contact and which cannot be introduced into a socket-outlet with an earthing contact

NOTE Class 0I appliances may have parts with double insulation or reinforced insulation, or parts operating at safety extra-low voltage.

2.2.18**class I appliance**

an appliance in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in such a way that means are provided for the connection of accessible conductive parts to the protective (earthing) conductor in the fixed wiring of the installation so that accessible conductive parts cannot become live in the event of a failure of the basic insulation

NOTE 1 Class I appliances may have parts with double insulation or reinforced insulation, or parts operating at safety extra-low voltage (see 2.2.22).

NOTE 2 For appliances intended for use with a flexible cord or cable, this provision includes a protective (earthing) conductor as part of the flexible cord or cable.

2.2.19**class II appliance**

an appliance in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions, such as double insulation or reinforced insulation, are provided, there being no provision for protective earthing or reliance upon installation conditions

such an appliance may be of one of the following types:

- a) an appliance having a durable and substantially continuous enclosure of insulating material that envelops all metal parts, with the exception of small parts, such as nameplates, screws and rivets, which are isolated from live parts by insulation at least equivalent to reinforced insulation; such an appliance is called an “insulation-encased class II appliance”;
- b) an appliance having a substantially continuous metal enclosure, in which double insulation is used throughout, except for those parts where reinforced insulation is used, because the application of double insulation is manifestly impracticable; such an appliance is called a “metal-encased class II appliance”;
- c) an appliance which is a combination of the types a) and b).

NOTE 1 The enclosure of an insulation-encased class II appliance may form a part or the whole of the supplementary insulation or of the reinforced insulation.

NOTE 2 If an appliance with double insulation and/or reinforced insulation throughout has an earthing terminal or earthing contact, it is considered to be of class I or class 0I construction. Class II appliances may be provided with means for maintaining the continuity of protective circuits, provided that such means are within the appliance and are insulated from accessible conductive parts by double insulation or reinforced insulation.

NOTE 3 Class II appliances may have parts operating at safety extra-low voltage.

2.2.20**class III appliance**

an appliance in which protection against electric shock relies on supply at safety extra-low voltage and in which voltages higher than this are not generated

NOTE Appliances intended to be operated at safety extra-low voltage and having internal circuits that operate at a voltage other than safety extra-low voltage are not included in the classification and are subject to additional requirements.

2.2.21**extra-low voltage**

a voltage supplied from a source within the appliance and, when the appliance is operated at its rated voltage, not exceeding 42 V between conductors and between conductors and earth or, for three-phase supply, not exceeding 24 V between conductors and neutral, the extra-low voltage circuit being separated from other circuits by basic insulation only

2.2.22**safety extra-low voltage**

a nominal voltage not exceeding 42 V between conductors and between conductors and earth or, for three-phase supply, not exceeding 24 V between conductors and neutral, the no-load voltage not exceeding 50 V and 29 V respectively

NOTE 1 When safety extra-low voltage is obtained from the supply mains, it is essential that it be through a safety isolating transformer (see 2.2.23) or a converter with separate windings.

NOTE 2 The voltage limits given are based on the assumption that the safety isolating transformer is operated at its rated supply voltage.

2.2.23**safety isolating transformer**

a transformer the input winding of which is electrically separated from the output windings by an insulation at least equivalent to double insulation or reinforced insulation, and which is designed to supply a distribution circuit, an appliance or other equipment at safety extra-low voltage

NOTE Transformers complying with BS 3535, without provision for earthing and with the appropriate output voltages are considered to be safety isolating transformers for the purposes of this standard.

2.2.24**portable appliance**

either an appliance that is moved while in operation or an appliance that can easily be moved from one place to another while connected to the supply

2.2.25**hand-held appliance**

a portable appliance intended to be held in the hand during normal use, the motor, if any, forming an integral part of the appliance

2.2.26**stationary appliance**

either a fixed appliance (see **2.2.27**) or an appliance having a mass exceeding 18 kg and not provided with a carrying handle

2.2.27**fixed appliance**

an appliance that is fastened to a support or otherwise secured in a specific situation

2.2.28**appliance for building-in**

an appliance intended to be installed in a cupboard fitment, sink unit, prepared recess in a wall or in a similar situation

NOTE In general, appliances for building-in do not have an enclosure on all sides because, for some of the sides, protection against electric shock is obtained after installation.

2.2.29**conditions of adequate heat discharge**

the conditions that apply when a heating appliance is operated under normal conditions of use

2.2.30**normal load**

the load to be applied to a motor-operated appliance so that the stress imposed corresponds to that occurring under normal conditions of use, any marking of short-time (see **2.2.33**) or intermittent operation (see **2.2.34**) being observed and, unless otherwise specified, heating elements, if any, being operated as in normal use

2.2.31**rated operating time**

the operating time assigned to the appliance by the manufacturer

2.2.32**continuous operation**

operation under normal load or in accordance with conditions of adequate heat discharge for an unlimited period

2.2.33**short-time operation**

operation under normal load or in accordance with conditions of adequate heat discharge for a specified period, starting from cold, the intervals between each period of operation being sufficient to allow the appliance to cool down approximately to room temperature

2.2.34**intermittent operation**

operation in a series of specified identical cycles, each cycle being composed of a period of operation under normal load or in accordance with conditions of adequate heat discharge, followed by a rest period with the appliance running idle or switched off

2.2.35**non-detachable part**

a part that cannot be removed without the aid of a tool (see **2.2.42**)

2.2.36**detachable part**

a part that can be removed without the aid of a tool (see **2.2.42**)

2.2.37**thermostat**

a temperature-sensing device, the operating temperature of which may be either fixed or adjustable and which, during normal operation, keeps the temperature of an appliance, or of parts of it, between certain limits by automatically opening and closing a circuit

2.2.38**temperature limiter**

a temperature-sensing device, the operating temperature of which may be either fixed or adjustable and which, during normal operation, operates by opening or closing a circuit when the temperature of an appliance, or of parts of it, reaches a predetermined value

NOTE A temperature limiter does not make the reverse operation during the normal duty cycle of the appliance. It may or may not require manual resetting.

2.2.39**thermal cut-out**

a device which, during abnormal operation, limits the temperature of an appliance, or of parts of it, by automatically opening the circuit or by reducing the current, and which is so constructed that its setting cannot be altered by the user

2.2.40**self-resetting thermal cut-out**

a thermal cut-out that automatically restores the current after the relevant part of the appliance has cooled down sufficiently

2.2.41**non-self-resetting thermal cut-out**

a thermal cut-out that requires resetting by hand, or replacement of a part, in order to restore the current

2.2.42**tool**

a screwdriver, a coin or any other object that may be used to operate a screw or similar fixing means

2.2.43**creepage distance**

the shortest path between two conductive parts, or between a conductive part and the bounding surface of the appliance, measured along the surface of the insulating material

2.2.44**clearance**

the shortest distance between two conductive parts, or between a conductive part and the bounding surface of the appliance, measured through air

NOTE The bounding surface of the appliance is the outer surface of the enclosure, considered as though metal foil were pressed into contact with accessible surfaces of insulating material.

2.2.45**all-pole disconnection**

for single-phase a.c. appliances and for d.c. appliances, disconnection of both supply conductors by a single switching action or, for appliances to be connected to more than two supply conductors, disconnection of all supply conductors, except the earthed (neutral) conductor, by a single switching action

NOTE The protective (earthing) conductor is not considered to be a supply conductor.

2.2.46**visibly glowing heating element**

a heating element which, when the appliance is assembled ready for use, is partly or completely visible from the outside of the appliance, and the temperature of which is at least 650 °C after the appliance has been operated in accordance with conditions of adequate heat discharge until steady conditions have been established, the supply voltage being such that the input is equal to the minimum rated input

2.2.47**accessible part or accessible surface**

a part or surface that can be touched by means of the test finger shown in Figure 1

2.2.48**body**

all accessible metal parts, shafts of handles, knobs, grips, etc. and metal foil in contact with all accessible surfaces of insulating material but excluding inaccessible metal parts

3 General requirements

3.1 Appliances shall be so designed and constructed that, in normal use, they function safely so as to cause no danger to persons or surroundings, even in event of such careless use as may occur in normal service.

TEST. In general, compliance shall be checked by carrying out all the relevant tests specified.

3.I Where the standard is used for the purposes of granting nationally recognized certification marks, designs or constructions to which the tests specified do not fully apply but which give an equivalent degree of safety and durability of safety, shall be deemed to comply with this standard, subject to the findings of a special investigation by the authority granting the certification mark and pending the issue of an amendment to the standard.

4 General conditions for the tests

4.1 Tests carried out in accordance with this standard are type tests.

4.2 Unless otherwise specified in this standard, the tests shall be carried out on a single sample as delivered, which has to withstand all the relevant tests.

NOTE 1 If it is evident from the design of the appliance that a particular test is not applicable, this test is not carried out.

NOTE 2 If the appliance is designed for different supply voltages, for both a.c. and d.c., for different speeds, etc., more than one sample may be required.

NOTE 3 If it is necessary to dismantle a class II appliance for the relevant tests, one additional sample is required.

NOTE 4 The testing of components may necessitate the submission of additional samples of these components. When the submission of such samples is necessary, they should be submitted together with the appliance.

4.3 Unless otherwise specified in this standard, the tests shall be carried out in the order of the clauses of this standard.

NOTE Before testing is started, the appliance has to be operated at rated voltage in order to verify that it is in working order.

4.4 The tests shall be carried out with the appliance, or any movable part of it, placed in the most unfavourable position that may occur in normal use.

4.5 If the test results are influenced by the temperature of the ambient air, the room temperature shall be, in general, maintained at 20 ± 5 °C. If, however, the temperature attained by any part is limited by a temperature-sensitive device, or is influenced by the temperature at which a change of state occurs, for example, the temperature of boiling water, the room temperature shall be, in case of doubt, maintained at 23 ± 2 °C.

4.6 Appliances for a.c. only shall be tested with a.c., at rated frequency, if marked; those for d.c. only shall be tested with d.c., and those for a.c./d.c. shall be tested at the more unfavourable supply.

Appliances for a.c. that are not marked with a rated frequency shall be tested at 50 Hz.

Appliances for a.c. that are marked with a rated frequency range of 50 Hz to 60 Hz shall be tested at 50 Hz or 60 Hz, whichever is the more unfavourable.

Appliances marked with a rated frequency range other than 50 Hz to 60 Hz shall be tested at the most unfavourable frequency within the range.

Appliances designed for more than one rated voltage shall be tested at the most unfavourable voltage.

Unless otherwise specified in this standard, appliances designed for one or more rated voltage ranges shall be tested at the most unfavourable voltage within the relevant range.

When it is specified in this standard, for motor-operated appliances marked with a rated voltage range, that the supply voltage is equal to the rated voltage multiplied by a factor, the supply voltage shall be equal to one of the following:

- a) the upper limit of the rated voltage range multiplied by this factor, if greater than one;
- b) the lower limit of the rated voltage range multiplied by this factor, if smaller than one.

NOTE 1 Where reference is made to maximum or minimum rated input, the rated input related to the upper limit or lower limit, respectively, of the rated voltage range is meant.

When testing appliances for d.c. only, the possible influence of polarity on the operation of the appliance shall be taken into consideration.

NOTE 2 If a heating appliance not incorporating a motor is designed for one rated voltage range, the upper limit of the voltage range will be the most unfavourable voltage within the range. If the appliance incorporates a motor or is designed for more than one rated voltage or rated voltage range, it may be necessary to carry out some of the tests at the minimum, the mean and the maximum values of the rated voltage or the rated voltage range in order to establish the most unfavourable voltage.

4.7 Appliances for which alternative heating elements or accessories are available shall be tested with those elements or accessories that give the most unfavourable results, provided that the elements or accessories used are within the appliance manufacturer's specification.

4.8 If, in normal use, the heating element cannot be operated unless the motor is running, the element shall be tested with the motor running. If the heating element can be operated without the motor running, the element shall be tested with or without the motor running, whichever is the more unfavourable.

4.9 Appliances provided with a thermostat, a regulating device or a similar control shall be tested with these controls adjusted to their most unfavourable setting, if the setting can be altered by the user.

NOTE 1 If the adjusting means of the control is accessible without the aid of a tool, **4.9** applies whether the setting can be altered by hand or with the aid of a tool. If the adjusting means is not accessible without the aid of a tool, **4.9** applies only if the setting can be altered by hand.

NOTE 2 Adequate sealing is regarded as preventing alteration of the setting by the user.

4.10 Where appropriate, appliances for building-in shall be installed in accordance with the manufacturer's instructions for installation, as far as these are in accordance with normal installation conditions.

4.11 Unless otherwise specified in this standard, appliances intended to be supplied by means of a flexible cable or cord shall be tested with the appropriate flexible cable or cord connected to the appliance.

4.12 When, for heating appliances, it is specified in this standard that the appliance has to be supplied at a voltage such that the input is greater than rated input, this voltage shall apply only to heating elements without an appreciable positive temperature coefficient of resistance. For other heating elements, this voltage shall be determined as follows.

The rated voltage is supplied until the heating element reaches its operating temperature. The supply voltage is then rapidly increased to the value necessary to give the input required for the relevant test and the test is carried out as specified, the value of the supply voltage being maintained throughout the test.

NOTE In general, the temperature coefficient is considered to be appreciable if, at rated voltage, the input of the appliance in cold condition differs by more than 25 % from the input at operating temperature.

4.13 When, for motor-operated appliances, the conditions of normal load are specified, the appliance shall be loaded in accordance with these conditions, irrespective of any marking of short-time or intermittent operation, unless it is evident from the design of the appliance that these conditions will not occur in normal use.

4.14 Class III appliances shall be tested together with their supply transformers if these are sold with the appliances.

4.15 For the purposes of **8.6**, **8.7**, **16.4**, **25.11** and **27.1**, parts separated from live parts by double insulation or reinforced insulation shall be regarded as not being likely to become live in the event of an insulation fault; connection of accessible metal parts to an earthing terminal or earthing contact does not remove the necessity for carrying out the relevant tests.

4.16 If class I appliances have accessible metal parts that are not connected to an earthing terminal or earthing contact and that are not separated from live parts by an intermediate metal part which is connected to an earthing terminal or earthing contact, such parts shall be checked for compliance with the appropriate requirements specified for class II appliances.

4.17 If class I or class II appliances have parts operating at safety extra-low voltage, such parts shall be checked for compliance with the appropriate requirements specified for class III appliances.

4.18 For testing appliances incorporating electronic circuits, see Appendix A.

5 Rating

5.1 The maximum rated voltage shall be as follows:

- 250 V for portable single-phase a.c. appliances and for portable d.c. appliances;
- 440 V for all other appliances.

TEST. Compliance shall be checked by inspection of the marking.

NOTE The requirements of this standard are based on the assumption that, in normal use, the voltage between the supply lines and earth does not exceed 254 V.

5.1 Single-phase appliances intended for direct connection to the UK mains supply shall have a rated voltage that covers use at 240 V and a rated frequency that covers use at 50 Hz.

TEST. Compliance shall be checked by inspection of the marking.

6 Classification

6.1 Appliances shall be classified as follows:

- a) according to protection against electric shock:
 - class I appliances;
 - class II appliances;
 - class III appliances.

NOTE 1 The class numbers are not intended to reflect the safety level of the appliances, but only the means by which the safety is obtained.

NOTE 2 If class III appliances are sold with a separate safety isolating transformer for their supply from the mains, their classification is not altered.

b) according to degree of protection against moisture:

- ordinary appliances;
- drip-proof appliances;
- splash-proof appliances;
- watertight appliances.

7 Marking

7.1 Appliances shall be marked with the following.

- a) Rated voltage(s) or rated voltage range(s), in volts, except that this is optional for appliances with detachable heating elements only.
- b) Symbol for nature of supply, if applicable.
- c) Rated frequency or rated frequency range, in hertz, unless the appliance is designed for d.c. only or for a.c. of both 50 Hz and 60 Hz.
- d) Rated input in watts or kilowatts, if greater than 25 W.

e) Rated current of the appropriate fuse-link, in amperes, for motor-operated appliances where the inrush current requires a fuse of a current rating higher than that appropriate to the marked rating (see **9.2**).

If the rated current of the appropriate fuse-link is marked and if the fuse-link is of the time/lag type, information about the time/current characteristic rating shall be included in the relevant marking.

f) Manufacturer's or responsible vendor's name, trade mark or identification mark.

g) Manufacturer's model or type reference.

h) Rated operating time, or rated operating time and rated resting time, in hours, minutes or seconds, if applicable.

i) Symbol for class II construction, for class II appliances only.

j) Symbol for degree of protection against moisture, if applicable.

Appliances for star-delta connection shall be clearly marked with the two rated voltages (e.g. 220 Δ /380 Y).

Rated input or rated current shall be the total maximum input or current of the circuits that can be in operation simultaneously.

If an appliance has alternative components that can be selected by a control device, the rated input given shall be that corresponding to the highest loading possible.

Motors with windings insulated with class B, class F or class H material only shall be marked with the class designation of their winding insulation.

Stationary appliances for multiple supply shall be marked with the substance of the following warning:

“BEFORE OBTAINING ACCESS TO
TERMINAL DEVICES, ALL SUPPLY
CIRCUITS MUST BE INTERRUPTED.”

This warning shall be visible when approaching any live part that might be touched during routine servicing.

NOTE 1 If the motor of an appliance is marked separately, the marking of the appliance and that of the motor should be such that there can be no doubt with regard to the rating and manufacturer of the appliance itself.

NOTE 2 Additional markings are allowed, provided they do not give rise to misunderstanding.

7.2 Appliances for short-time operation or intermittent operation shall be marked with rated operating time or rated operating time and rated resting time respectively, unless the operating time is either limited by the construction of the appliance or it corresponds to the operating conditions given in 11.7.

The marking of short-time operation or intermittent operation shall correspond to normal use.

The marking of intermittent operation shall be such that the rated operating time precedes the rated resting time, both markings being separated by an oblique stroke.

7.3 Detachable heating elements shall be marked with the following:

- a) rated voltage(s) or rated voltage range(s), in volts;
- b) rated input, in watts or kilowatts, if greater than 25 W;
- c) manufacturer’s name or responsible vendor’s name, trade mark or identification mark;
- d) manufacturer’s model or type reference;
- e) symbol for degree of protection against moisture, if applicable.

7.4 Except for appliances for star-delta connection, if the appliance can be adjusted to suit different rated voltages or different rated inputs, the voltage or input to which the appliance is adjusted shall be easily and clearly discernible.

NOTE For appliances for which frequent changes in voltage setting are not required, the requirement is considered to be complied with if the rated voltage or the rated input to which the appliance is adjusted can be determined from a wiring diagram fixed to the appliance. This wiring diagram may be on the inside of a cover which has to be removed to connect the supply conductors. This diagram may be on a card riveted to the cover, or on a paper or similar label secured to the cover by an adhesive.

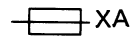
If a wiring diagram is used it shall not be on a label loosely attached to the appliance.

7.5 For appliances or detachable heating elements marked with more than one rated voltage or rated voltage range, the rated input for each of these voltages or ranges shall be marked, if greater than 25 W.

The upper and lower limits of the rated input shall be so marked on the appliance or detachable heating element that the relation between input and voltage appears distinctly unless the difference between the limits of a rated voltage range does not exceed 10 % of the mean value of the range, in which case the marking for rated input may be related to the mean value of the range.

If the input of the appliance or detachable heating element in cold condition differs by more than 25 % from the input at operating temperature, the input in cold condition shall be marked in addition, and shall be placed in brackets after the marking of the input at operating temperature.

7.6 When symbols are used, they shall be as follows.

V	volts
A	amperes
Hz	hertz
W	watts
kW	kilowatts
μF	microfarads
l	litres
kg	kilograms
^a N/cm ²	newtons per square centimetre
^a Pa	pascals
^a bar	bar
h	hours
min	minutes
s	seconds
~	alternating current (417-IEC-5032a, BS 6217:1981)
3 ~	three-phase alternating current
3N ~	three-phase alternating current with neutral
---	direct current (417-IEC-5031a, BS 6217:1981)
	fuse-link (417-IEC-5016a, BS 6217:1981)
 XA	rated current of the appropriate fuse-link where X is the numerical value of the current

	time-lag D-type fuse-link
	time-lag miniature fuse-link where X is the symbol for time/current characteristic as given in BS 4265
	class II construction (417-IEC-5172a, BS 6217:1981)
	drip-proof construction
	splash-proof construction
	watertight construction
	earth (417-IEC-5016a, BS 6217:1981)

^a For the purposes of this standard, the recommended unit of pressure is the bar and preference should be given to its use. 1 bar = 10^5 N/m² = 100 kPa.

The symbol for nature of supply shall be placed next to the marking for rated voltage.

The dimensions of the symbol for class II construction shall be such that the length of the sides of the outer square is about twice the length of the sides of the inner square. The length of the sides of the outer square shall be not less than 5 mm, unless the largest dimension of the appliance does not exceed 150 mm, in which case the dimensions of the symbol may be reduced, but the length of the sides of the outer square shall be not less than 3 mm.

The symbol for class II construction shall be so placed that it will be obvious that it is a part of the technical information and is unlikely to be confused with any other marking.

NOTE This list of symbols is not exclusive and other symbols for different purposes are allowed if they do not lead to misunderstanding.

7.7 For class I appliances, the line terminal shall be indicated by the letter L.

Terminals intended exclusively for the neutral conductor shall be indicated by the letter N.

Earthing terminals shall be indicated by the earth symbol shown in 7.6.

These indications shall not be placed on screws, removable washers or other parts that might be removed when conductors are being connected.

If, for single-phase class I appliances intended to be permanently connected to fixed wiring, a single-pole switch or a single-pole protection device is inserted in the line conductor inside the appliance, the corresponding terminal shall be clearly indicated to enable the correct connection to the supply to be made.

7.8 Appliances to be connected to more than two supply conductors and appliances for multiple supply shall be provided with a connection diagram, fixed to the appliance, unless the correct mode of connection is obvious.

For appliances for star-delta connection, the connection diagram shall show how the windings are to be connected.

The correct mode of connection is considered to be obvious if, for three-phase appliances, the terminals for the supply conductors are indicated by arrows pointing towards the terminals. The earthing conductor is not a supply conductor.

Marking in words is an acceptable means of indicating the correct mode of connection.

The connection diagram may be the wiring diagram referred to in 7.4.

7.9 Unless it is obviously unnecessary, switches, the operation of which might cause a hazard, shall be so marked or placed that they indicate clearly which part of the appliance they control. Indications used for this purpose shall, wherever practicable, be comprehensible without a knowledge of languages, national standards, etc.

7.10 The different positions of regulating devices, and the different positions of switches on stationary appliances shall be indicated by figures, letters or other visual means. The “off” position shall not be indicated by words only.

If figures are used for indicating the different positions, the “off” position shall be indicated by the figure zero and the position for a greater output, input, speed, cooling effect, etc., shall be indicated by a higher figure.

The figure zero shall not be used for any other indication.

7.11 Thermostats, regulating devices, etc. intended to be adjusted during installation or in normal use, shall be provided with an indication for the direction of adjustment to increase or to decrease the value of the characteristic being adjusted.

NOTE An indication of the symbol + and the symbol – is considered to be sufficient.

7.12 If it is necessary to take special precautions when installing or using the appliance, details of these shall be given in an instruction sheet that accompanies the appliance.

If a stationary appliance is not provided with a non-detachable flexible cable or cord intended to be connected to a plug or with other means for disconnection from the supply having a contact separation of at least 3 mm in all poles, the instruction sheet shall state that such means for disconnection have to be incorporated in the fixed wiring.

If the supply wires of an appliance can come into contact with parts of a terminal block or compartment for fixed wiring and these parts have, under conditions of normal use, a temperature such that the insulation of the wire is subjected to a temperature rise exceeding that specified in Table 3, the instruction sheet shall also state that the appliance is to be connected by means of wires having appropriate *T*-marking or temperature rating.

NOTE Special precautions may be necessary, for example, for appliances for building-in.

In order to ensure that after building-in, the conditions necessary to comply with this standard are achieved, the instruction sheet for appliances for building-in should give clear information with regard to the following:

- a) dimensions of the space to be provided for the appliance;
- b) dimensions and position of the means for supporting and fixing the appliance within this space;
- c) minimum clearances between the various parts of the appliance and the surrounding parts of the fitment;
- d) minimum dimensions of ventilating openings and their correct arrangement;
- e) connection of the appliance to the supply and the inter-connection of separate components, if any.

For appliances with type Z attachment the instruction sheet shall contain the substance of the following information.

“The supply cord of this appliance cannot be replaced; if the cord is damaged, the appliance should be discarded.”

7.13 Instruction sheets and other texts required by this standard shall be written in the official language(s) of the country in which the appliance is to be sold. For appliances for sale in the UK, instructions shall be in English.

Where symbols are used, they shall be those indicated in this standard, although additional symbols are permitted if they do not give rise to misunderstanding.

TEST for 7.1 to 7.13. Compliance with 7.1 to 7.13 shall be checked by inspection.

7.14 Marking required by this standard shall be easily legible and durable.

Marking specified in 7.1 to 7.5 shall be on a main part of the appliance or detachable heating element.

The marking of fixed appliances shall be clearly discernible from the outside after the appliance has been fixed as in normal use but, if necessary, after removal of a cover.

The marking of other appliances shall be clearly discernible from the outside, if necessary after removal of a cover; for portable appliances, the removal of this cover shall not require the use of a tool.

For stationary appliances, the marking shall be beneath a cover only if it is near to the terminals for external conductors.

Marking on detachable heating elements shall be clearly discernible when the element is removed from the appliance.

Marking on, and indications for, switches, thermostats, thermal cut-outs and other control devices shall be placed in the vicinity of these components; they shall not be placed on removable parts if these parts can be replaced in such a way that the marking is misleading.

TEST. Compliance shall be checked by inspection and by rubbing the marking by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with petroleum spirit.

After all the tests specified in this standard, the marking shall be easily legible. It shall not be possible to remove marking plates easily and they shall show no curling.

NOTE 1 A revision of the test for checking the durability of the marking is under consideration.

NOTE 2 In considering the durability of the marking, the effect of normal use is taken into account. Thus, for example, marking by means of paint or enamel other than vitreous enamel on containers that are likely to be cleaned frequently is not considered to be durable.

7.1A A label shall be attached to the flexible cord of all class I appliances fitted with a flexible cable or cord having cores coloured green-and-yellow, blue and brown. This label shall state the following.

“IMPORTANT

The wires in this mains lead are coloured in accordance with the following code.

Green-and-yellow: Earth

Blue: Neutral

Brown: Live”

In addition, the user instructions and label shall include the substance of the following.

“As the colours of the wires in the mains lead of this appliance may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows.

The wire that is coloured green-and-yellow must be connected to the terminal in the plug which is marked with the letter E or by the earth symbol  or coloured green or green-and-yellow.

The wire that is coloured blue must be connected to the terminal that is marked with the letter N or coloured black.

The wire that is coloured brown must be connected to the terminal that is marked with the letter L or coloured red.”

For class II appliances fitted with a flexible cord, instructions shall be given by the manufacturer for the correct connection of the plug. These instructions shall make it clear that neither core is to be connected to the earth terminal of a three-pin plug.

TEST. Compliance shall be checked by inspection.

7.II For portable class I appliances the following warning notice shall be given on a label attached to the end of the flexible cord:

“WARNING — THIS APPLIANCE MUST BE EARTHED”

For all class I appliances the warning shall be included in the user instructions.

NOTE The label specified in **7.I** may be used for this purpose; a separate label is not required.

TEST. Compliance shall be checked by inspection.

7.III For appliances fitted with a flexible cord and with a rated input exceeding 3 kW, a label shall be attached to the flexible cord stating that the appliance shall be connected to an outlet having a rated current greater than 13 A and that a 13 A (BS 1363) plug is therefore not suitable.

TEST. Compliance shall be checked by inspection.

NOTE For appliances intended for export, alternative labelling to that specified in **7.I** to **7.III** may be required.

8 Protection against electric shock

8.1 Appliances shall be so constructed and enclosed that there is adequate protection against accidental contact with live parts and, for class II appliances, with metal parts separated from live parts by basic insulation only. This requirement applies for all positions of the appliance when it is wired and operated as in normal use, even after opening of lids and doors and removal of detachable parts, except for lamps located behind a detachable cover, provided that the appliance can be isolated from the supply by means of a plug or an all-pole switch, the “off” position of which is clearly indicated. During the insertion or removal of lamps, protection against accidental contact with live parts of the lamp cap shall also be ensured.

There shall be, in addition, adequate protection against the risk of contact with basic insulation. Such insulation may, however, be accessible after removing a cover that requires the use of tools for removal and has to be removed for user maintenance, or after removing a cover that can be removed without tools if marked “Remove plug before removing this cover” or “Disconnect from the mains before removing this cover”.

The insulating properties of lacquer, enamel, ordinary paper, cotton, oxide film on metal parts, beads and sealing compound shall not be relied upon to give the required protection against accidental contact with live parts.

The enclosure of the appliance shall have no openings, other than those necessary for the use and working of the appliance, giving access to live parts and, for class II appliances, to parts separated from live parts by basic insulation only.

For the purpose of assessing compliance with these requirements the following conditions shall apply.

a) Unless otherwise specified in this standard, parts operating at safety extra-low voltage not exceeding 24 V are not considered to be live parts.

b) If a manufacturer instructs the user to remove a part during normal operation or user maintenance, that part is regarded as a detachable part even if a tool has to be used for its removal.

NOTE The requirements of **8.1** preclude the use of screw-type fuses, and screw-type miniature circuit-breakers if they are accessible without the aid of a tool. It implies that sockets used as terminal devices for detachable heating elements have to be so designed as to prevent accidental contact with live parts when the heating element has been removed.

c) Self-hardening resins are not regarded as sealing compound.

TEST. Compliance shall be checked by inspection and, except as specified for visibly glowing heating elements and parts supporting such elements, by a test with the test finger shown in Figure 1.

In addition, all apertures in class II appliances and apertures in class I appliances other than those in metal parts connected to an earthing terminal or earthing contact and those giving access to live parts in socket outlets and lamp caps, shall be tested with test pin I shown in Figure 2 (identical with test pin I specified in BS 3042:1971). The test finger and the test pin are applied, without appreciable force, in every possible position, except that appliances normally used on the floor and having a mass exceeding 40 kg are not tilted.

Appliances for wall-mounting and appliances for building-in shall be tested as delivered.

An appliance designed as a single appliance but delivered as a number of units shall be tested after assembly.

For appliances provided with movable devices, such as those intended for varying the heat distribution or the tension of belts, the test shall be carried out with the devices adjusted to their most unfavourable position within their range of adjustment.

Apertures preventing the entry of the finger shall be further tested by means of a straight unjointed test finger of the same dimensions, which is applied with a force of 20 N; if this finger enters, the test with test finger I is repeated, the finger being introduced through the aperture. If the unjointed test finger does not enter, the force applied is increased to 30 N. If then the guard is so displaced or the aperture so distorted that the test finger shown in Figure 1 can be inserted without force, the test with the latter finger is repeated. An electrical contact indicator shall be used to show contact.

It shall not be possible to touch bare live parts or live parts protected by lacquer, enamel, ordinary paper, cotton, oxide film, beads or sealing compound only, with the test finger shown in Figure 1.

It shall not be possible to touch basic insulation with the test finger shown in Figure 1 unless it is under a detachable cover that either requires the use of a tool for removal or is marked, "Remove plug before removing this cover" or "Disconnect from the mains before removing this cover".

For class II appliances it shall not be possible to touch bare live parts with test pin I of BS 3042 or to touch metal parts separated from live parts by basic insulation only with the test finger shown in Figure 1.

For appliances other than those of class II, the test for live parts of visibly glowing heating elements, all poles of which can be disconnected by a single switching action, and for parts supporting such elements, provided that it is obvious from the outside of the appliance, without removing covers, etc., that these parts are in contact with the element, shall be made with the test probe shown in Figure 3 (identical with the test probe specified in BS 3042) instead of the test finger, the probe being applied without appreciable force. It shall not be possible to touch live parts with this probe.

NOTE 1 When applying the test finger shown in Figure 1, either or both of the jointed sections should be turned through any angle up to 90° with respect to the axis of the finger and in the same direction only.

NOTE 2 It is recommended that a lamp be used for the indication of contact and that the voltage be not less than 40 V.

NOTE 3 The fact that appliances for wall-mounting and appliances for building-in are tested as delivered does not imply that such appliances have to be completely enclosed; the basic insulation of wiring in appliances other than those of class II may give the required protection against electric shock, provided it is adequately protected or enclosed after installation of the appliance.

8.2 For appliances for skin or hair treatment, other than those of class III having a rated voltage not exceeding 24 V, metal parts that are in contact with skin or hair of persons or animals in normal use shall be separated from live parts by double insulation or reinforced insulation and shall not be earthed.

TEST. Compliance shall be checked by inspection and by the tests specified for double insulation and reinforced insulation.

8.3 For appliances other than those of class III, flexible shafts that are handled in normal use shall be insulated from the motor shafts by suitable couplings of insulating material.

TEST. Compliance shall be checked by inspection and by the tests specified for supplementary insulation (see clause 16).

8.4 Conducting liquids that are or may become accessible in normal use shall not be in direct contact with live parts other than those operating at safety extra-low voltages not exceeding 24 V.

For class II appliances, such liquids shall not be in direct contact with basic insulation or with metal parts insulated from live parts by basic insulation only.

TEST. Compliance shall be checked by inspection.

8.5 Shafts of operating knobs, handles, levers, etc. shall not be live.

TEST. Compliance shall be checked by inspection.

8.6 For appliances other than those of class III, handles, levers and knobs that are held or actuated in normal use shall not become live in the event of an insulation fault. If these handles, levers or knobs are of metal, and if their shafts or fixings are likely to become live in the event of an insulation fault, they shall either be adequately covered by insulating material or their accessible parts shall be separated from their shafts or fixings by supplementary insulation.

For stationary appliances, this requirement does not apply to handles, levers and knobs, other than those of electrical components, provided they are either reliably connected to an earthing terminal or earthing contact, or separated from live parts by earthed metal.

TEST. Compliance shall be checked by inspection and, if necessary, by the tests specified for supplementary insulation (see Clause 16).

8.7 For appliances other than those of class III, handles which, in normal use, are continuously held in the hand shall be so constructed that, when gripped as in normal use, contact between the operator's hand and metal parts that may become live in the event of an insulation fault is unlikely.

TEST. Compliance shall be checked by inspection and by manual test.

8.8 For class II appliances, capacitors shall not be connected to accessible metal parts, and their casings, if of metal, shall be separated from accessible metal parts by supplementary insulation.

TEST. Compliance shall be checked by inspection and by the tests specified for supplementary insulation (see clause 16).

8.9 Appliances intended to be connected to the supply by means of a plug shall be so designed that in normal use there is no risk of electric shock from charged capacitors when touching the pins of the plug.

TEST. Compliance shall be checked by the following test, which is carried out ten times.

The appliance is operated at rated voltage or at the upper limit of the rated voltage range.

The appliance switch, if any, is then moved to the “off” position and the appliance is disconnected from the supply by means of the plug.

The voltage between the pins of the plug is measured 1 s after disconnection with an instrument that does not appreciably affect the value to be measured.

This voltage shall not exceed 34 V.

NOTE Capacitors having a rated capacitance not exceeding 0.1 μF are not considered to entail a risk of electric shock.

9 Starting of motor-operated appliances

9.1 Motors shall start under all normal voltage conditions that may occur in use.

Centrifugal and other automatic starting switches shall operate reliably and without contact chattering.

Motors to be started by hand shall cause no danger if they are started in the wrong direction.

TEST. Compliance shall be checked by starting the appliance three times at a voltage equal to 0.85 times rated voltage, the appliance being at room temperature at the beginning of the test.

The motor shall be started each time under the conditions occurring at the beginning of normal operation or, for automatic appliances, at the beginning of the normal cycle of operation, the motor being allowed to come to rest between successive starts.

For appliances provided with motors having other than centrifugal starting switches, this test shall be repeated at a voltage equal to 1.06 times rated voltage. Motors to be started by hand are started in the correct direction and, if possible, in the wrong direction.

In all cases, the appliance shall function in such a way that safety is not affected.

NOTE The supply source is such that, during the test, the drop in voltage does not exceed 1 %.

9.2 The starting current shall not blow a quick-acting fuse-link having a rated current as follows:

- a) according to the marking, if the rated current of the appropriate fuse-link is marked on the appliance;
- b) equal to the rated current of the appliance, with a minimum of 10 A for appliances having a rated voltage exceeding 130 V and 16 A for appliances having a rated voltage of 130 V and less, if the rated current of the appropriate fuse-link is not marked on the appliance.

TEST. Compliance shall be checked by the following test.

The appliance is connected in series with a silver wire having a length of 85 mm and the diameter given in Table 1.

Table 1 — Diameter of silver wire for fuse test

Rated current of fuse	Diameter of silver wire	
	Starting time not exceeding 1 s	Starting time exceeding 1 s
A	mm	mm
10	0.29	0.39
16	0.39	0.52
20	0.46	0.60
25	0.53	0.66

The wire has a silver content not less than 99.9 %, and it is stretched horizontally along the centre line of a box with inside dimensions of 80 mm $\times$ 80 mm $\times$ 150 mm.

The appliance is so loaded that the conditions for starting are the most unfavourable encountered in normal use. Heating elements incorporated in the appliance are operated but they are not connected to a separate supply.

The appliance is then started 10 times at a voltage equal to 0.9 times rated voltage and 10 times at a voltage equal to 1.1 times rated voltage. The interval between consecutive starts is made sufficiently long to prevent undue heating and not less than 5 min.

During the test, the silver wire shall not melt and neither shall any overload protection device operate.

NOTE 1 The supply source is such that, during the test, the drop in voltage does not exceed 1 %.

NOTE 2 A revision of this test is under consideration.

9.3 Overload protection devices shall not operate under normal starting conditions.

TEST. Compliance shall be checked during the test described in 9.2.

10 Input and current

10.1 The input of the appliance and of detachable heating elements at rated voltage and at normal operating temperature shall not deviate from the rated input by more than the deviation given in Table 2.

For appliances and detachable heating elements marked with a rated voltage range having limits differing by more than 10 % of the mean value of the range, the permissible deviations apply for both limits of the range.

For combined appliances, the input for the appliance as a whole shall be checked. If the deviation exceeds either that specified for heating appliances for that total rated input or that specified for motor-operated appliances for that total rated input, whichever is the smaller, the inputs to the heating and motor-operated parts of the appliance shall be measured separately for compliance with this requirement.

TEST. Compliance shall be checked by measuring the input of the appliance or detachable heating element, operated at rated voltage (see 10.3) and in accordance with conditions of adequate heat discharge and/or under normal load, when the input has stabilized. If the motor load varies throughout the operating cycle, the input shall be measured by means of a watt-hour meter, and determined as the mean value of the input occurring during a representative period.

10.2 If a motor-operated appliance is marked with rated current, the current taken by the appliance shall not exceed the rated current by more than 10 %.

TEST. Compliance shall be checked by measuring the current taken by the appliance operating under normal load, rated voltage and rated frequency.

NOTE For appliances and detachable heating elements marked with one or more rated voltage ranges, the tests specified in 10.1 to 10.3 are carried out at both the upper and lower limits of the ranges, unless the marking of the rated input is related to the mean value of the relevant voltage range, in which case the tests are carried out at a voltage equal to the mean value of that range.

10.3 If a heating appliance or detachable heating element has a marking for the input in cold condition, this shall not differ by more than 20 % from the marked value.

TEST. Compliance shall be checked by inspection and by measurement.

11 Heating

11.1 Appliances and their surroundings shall not attain excessive temperatures in normal use.

TEST. Compliance shall be checked by determining the temperature rise of the various parts under the conditions specified in 11.2 to 11.7.

11.2 Hand-held appliances shall be suspended in their normal position, in still air.

Appliances for building-in shall be built in using dull black-painted plywood walls, about 20 mm thick.

Other heating appliances shall be placed in a test corner. The test corner consists of two walls at right angles, a floor and, if necessary, a ceiling, all of dull black-painted plywood having a thickness of 20 mm. The appliance shall be positioned in the test corner as follows.

- a) Appliances normally used on a floor or a table shall be placed on the floor as near to the walls as possible.
- b) Appliances normally fixed to a wall shall be mounted on one of the walls, as near to the other wall and to the floor or ceiling as is likely to occur in normal use, unless the manufacturer has given other instructions concerning their installation.
- c) Appliances normally fixed to a ceiling shall be fixed to the ceiling as near to the walls as is likely to occur in normal use, provided the manufacturer has not given special instructions concerning their installation.

Table 2 — Permissible variations in rated input

Type	Rated input	Deviation
Heating appliance	W	
	Not exceeding 100 Exceeding 100	± 10 % + 5 % or – 10 %, or 10 W, whichever is the greater
Motor-operated appliance	Up to and including 33.3	+ 10 W ^a
	Over 33.3 up to and including 150	+ 30 % ^a
	Over 150 up to and including 300	+ 45 W ^a
	Over 300	+ 15 % ^a

^a For motor-operated appliances, the negative deviation is not limited.

Other motor-operated appliances shall be placed on, or fixed to, a support of dull black-painted plywood having a thickness of 20 mm, as follows.

- 1) Appliances normally used on a floor or a table shall be placed on a horizontal support.
- 2) Appliances normally fixed to a wall shall be mounted on a vertical support.
- 3) Appliances normally fixed to a ceiling shall be fixed to the underside of a horizontal support.

11.3 Temperature rises other than those of windings shall be determined by means of fine-wire thermocouples so chosen and positioned that they have the minimum effect on the temperature of the part under test.

Thermocouples used for determining the temperature rise of the surface of walls, ceiling and floor shall be attached to the back of small blackened discs of copper or brass, 15 mm in diameter and 1 mm thick, which are flush with the surface.

As far as possible, the appliance shall be so positioned that parts likely to attain the highest temperatures touch the discs.

In determining the temperature rises of handles, knobs, grips, etc., consideration shall be given to all parts that are gripped in normal use and, if of insulating material, to parts that are in contact with hot metal.

The temperature rise of electrical insulation, other than that of windings, shall be determined on the surface of the insulation, at places where failure could cause a short circuit, contact between live parts and accessible metal parts, bridging of insulation or reduction of creepage distances or clearances below the values specified in **29.1**.

Temperature rises of windings shall be determined by the resistance method unless the windings are non-uniform or it involves severe complications to make the necessary connections, in which case the temperature rise shall be determined by means of thermocouples.

NOTE 1 If it is necessary to dismantle the appliance to position thermocouples, the input should be measured again to check that the appliance has been correctly reassembled.

NOTE 2 The point of separation of the cores of a multicore cable or cord and the place at which insulated wires enter lampholders are examples of places where thermocouples are positioned.

11.4 Heating appliances shall be operated in accordance with conditions of adequate heat discharge, with all heating elements in circuit, the supply voltage being such that the input is 1.15 times the maximum rated input.

11.5 Motor-operated appliances shall be operated under normal load and at the most unfavourable voltage between 0.94 times the minimum rated voltage and 1.06 times the maximum rated voltage.

11.6 For combined appliances, when the motors are operated at a voltage equal to 1.06 times the maximum rated voltage, the input to the heating elements shall be as specified in **11.4**. When the motors are operated at a voltage equal to 0.94 times the minimum rated voltage, the input to the heating elements shall be reduced to 0.90 times the minimum rated input.

NOTE If it is necessary to carry out the test at an intermediate voltage, the input of the heating elements should be adjusted proportionately.

11.7 The appliance shall be operated as follows:

- a) for the rated operating time for appliances for short-time operation;
- b) on consecutive cycles of operation, until steady conditions are established, for appliances for intermittent operation, the “on” and “off” periods being the rated “on” and “off” periods;
- c) until steady conditions are established for appliances for continuous operation.

11.8 During the test, thermal cut-outs shall not operate. Sealing compound, if any, shall not flow out. The temperature rises shall be monitored continuously and they shall not exceed the values given in Table 3, except that it is permissible to exceed the temperature rise limits in Table 3 if it can be shown that the temperatures are not in excess of the thermal capabilities of the materials as determined by ageing tests made on the materials themselves. It is permissible to use other materials not listed in Table 3 under the same conditions.

For appliances that are not subjected to the test of clause **12**, the measurements specified in **13.1** shall be made at the end of this test.

The values in Table 3 are based on an ambient temperature not normally exceeding 25 °C but occasionally reaching 35 °C. However, the temperature rise values specified are based on 25 °C.

The value of the temperature rise, Δt (in K), of a copper winding shall be calculated from the following equation:

$$\Delta t = \frac{R_2 - R_1}{R_1} (234.5 + t_1) - (t_2 - t_1)$$

where

- R_1 is the resistance at the beginning of the test (in Ω);
- R_2 is the resistance at the end of the test (in Ω);
- t_1 is the room temperature at the beginning of the test (in °C);
- t_2 is the room temperature at the end of the test (in °C).

At the beginning of the test, the windings shall be at room temperature.

NOTE 1 It is recommended that the resistance of windings at the end of the test be determined by taking resistance measurements as soon as possible after switching off and then at short intervals so that a curve of resistance against time can be plotted for ascertaining the resistance at the instant of switching off.

NOTE 2 The classification of handles, knobs, grips and the like according to their materials is derived from the constant, b , as follows:

$$b = \sqrt{\lambda \cdot c \cdot \gamma}$$

where

- λ is the thermal conductivity of the material [in W/(m K)];
- c is the specific heat of the material [in J/(kg K)];
- γ is the specific mass of the material (in kg/m³).

The materials are classified as follows:

- value of b greater than 3 500 denotes a metal;
- value of b between 1 000 and 3 500 denotes a porcelain or vitreous material;
- value of b less than 1 000 denotes a moulded material, rubber or wood.

An alternative method of determining the constant, b , is as follows:

Samples of materials with known values of the constant, b , and a sample of the material to be classified, all samples having the same dimensions, are fixed to a heated metal plate.

The temperatures of the upper surfaces of the various samples are measured and the temperatures of the reference samples are plotted as a function of the constant, b .

The constant, b , of the material to be classified is derived from this curve by reading off the value of b , corresponding to the temperature attained by the sample under investigation.

11.9 For appliances provided with an automatic cord reel, one-third of the total length of the cable or cord shall be unreel. The temperature rise of the rubber or polyvinyl chloride insulation shall then be determined as nearly as possible to the hub of the reel and between the two outer-most layers of the cable or cord on the reel.

The temperature rise of the insulation shall not exceed the relevant value specified in Table 3 and the temperature rise of the sliding contacts of the reel shall not exceed 65 K.

12 Operation under overload conditions of appliances with heating elements

12.1 Appliances with heating elements shall be so designed and constructed that they withstand overloads that are liable to occur in normal use.

TEST. Compliance shall be checked by the test specified in **12.2** and, if applicable, by the test specified in **12.3**.

After the tests, the appliance shall show no damage within the meaning of this standard. In particular, heating wires, internal wiring and the general assembly shall not show such deformation that creepage distances and clearances are reduced below the values specified in **29.1**. Contacts and connections shall not have worked loose.

12.2 Hand-held appliances shall be suspended in their normal position, in still air.

Appliances normally used on the floor or a table shall be placed on a horizontal support, away from walls.

Appliances normally fixed to a wall shall be fixed to a wall, as near as possible to the floor or to a ceiling as is likely to occur in normal use, unless specific instructions are given by the manufacturer.

The appliance shall be subjected to 15 cycles, each cycle comprising an operating period as specified in **11.7**, in accordance with conditions of adequate heat discharge, and a cooling period sufficient to allow the appliance to cool down to approximately room temperature.

Throughout the operating period, all heating elements that can be operated at the same time shall be in circuit, the supply voltage being such that the input is as follows:

- a) 1.33 times rated input, for appliances having a rated input not exceeding 100 W;
- b) 1.27 times rated input or 1.21 times rated input plus 12 W, whichever is the greater, for appliances having a rated input exceeding 100 W.

If a self-resetting thermal cut-out or a non-self-resetting thermal cut-out that is accessible and can be reset without the aid of a tool operates, the operating period is considered to be ended. The appliance is then allowed to cool down and the cut-out is reset for the next cycle.

During the test, non-self-resetting thermal cut-outs that are accessible only with the aid of a tool or which require the replacement of a part shall not operate and no vapour or ignitable gas shall accumulate in the appliance.

NOTE 1 Forced cooling may be used for the purpose of shortening the cooling period.

NOTE 2 For appliances incorporating a motor, the operation of which may affect the conditions of the heating elements, the motor is operated from a separate supply at rated voltage and under normal load.

12.3 Appliances provided with a pressure switch shall be subjected to an additional test under the conditions specified in **12.2**, but the operating and cooling periods shall be each approximately 5 min and the current shall be interrupted by controlling the working pressure.

Table 3 — Permissible temperature rises

Part	Temperature rise K
Windings ^a , if the winding insulation is:	
of class A material ^b	75 (65)
of class E material ^b	90 (80)
of class B material ^b	95 (85)
of class F material ^b	115
of class H material ^b	140
Pins of appliance inlets:	
for very hot conditions	130
for hot conditions	95
for cold conditions	40
Terminals, including earthing terminals, for external conductors of stationary appliances, unless they are provided with a power supply cord	60
Ambient of switches and thermostats ^c :	
without <i>T</i> -marking or temperature rating	30
with <i>T</i> -marking or temperature rating	<i>T</i> – 25
Rubber or polyvinyl chloride insulation of internal and external wiring including power supply cords:	
without <i>T</i> -marking or temperature rating	50 ^d
with <i>T</i> -marking or temperature rating	<i>T</i> – 25 ^e
Cord sheaths used as supplementary insulation	35
Rubber, other than synthetic, used for gaskets or other parts, the deterioration of which could affect safety:	
when used as supplementary insulation or as reinforced insulation	40
in other cases	50
Lampholders E26 and E27:	
metal or ceramic type	160
insulated type, other than ceramic	120
with <i>T</i> -marking	<i>T</i> – 25
Lampholders E14, B15 and B22:	
metal or ceramic type	130
insulated type, other than ceramic	90
with <i>T</i> -marking	<i>T</i> – 25
Material used as insulation other than that specified for wires and windings ^f	
impregnated or varnished textile, paper or press board	70
laminates bonded with:	
melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins	85 (175)
urea-formaldehyde resin	65 (150)
mouldings of:	
phenol-formaldehyde with cellulose fillers	85 (175)
phenol-formaldehyde with mineral fillers	100 (200)
melamine-formaldehyde	75 (150)
urea-formaldehyde	65 (150)
polyester with glass fibre reinforcement	110
silicone rubber	145
polytetrafluoroethylene	265
pure mica and tightly sintered ceramic material, when such materials are used as supplementary insulation or reinforced insulation	400
thermoplastic material ^g	—

Table 3 — Permissible temperature rises

Part	Temperature rise K
Wood, in general ^h	65
wooden supports, walls, ceiling and floor of the test corner and wood cabinets:	
stationary appliances specifically mentioned in the relevant Section of BS 3456-3	60
as being liable to be operated continuously for long periods	65
other appliances	65
Outer surface of capacitors:	
with marking of maximum operating temperature (T)	$T - 35$
without marking of maximum operating temperature:	
small ceramic capacitors for radio and television interference suppression	50
other capacitors	20
External enclosure of appliances without heating elements, except handles held in normal use	60
Handles, knobs, grips and the like which, in normal use, are continuously held (e.g. of soldering irons):	
of metal	30
of porcelain or vitreous material	40
of moulded material, rubber or wood	50
Handles, knobs, grips, etc. which, in normal use, are held for short periods only (e.g. of switches):	
of metal	35
of porcelain or vitreous material	45
of moulded material, rubber or wood	60
Parts in contact with oil having a flash-point of t °C	$t - 50$
Any point where the insulation of wires can come into contact with parts of a terminal block or compartment for fixed wiring of a stationary appliance not provided with a power supply cord:	
where the instructions require T -marked or temperature rated wires	$T - 25^e$
in other cases	50^d

^a To allow for the fact that the temperature of windings of universal motors, relays, solenoids, etc. is usually below the average at the points where thermocouples are placed, the figures without parentheses apply when the resistance method is used and those within parentheses apply when thermocouples are used. For windings of vibrator coils and a.c. motors, the figures without parentheses apply in both cases.

^b The classification is in accordance with BS 2757.

Examples of class A material are:

impregnated cotton, silk, artificial silk and paper;
enamels based on oleo-or polyamide resins.

Examples of class B material are:

asbestos, glass fibre, melamine formaldehyde and phenol formaldehyde resins.

Examples of class E material are:

mouldings with cellulose fillers, cotton fabric laminates and paper laminates, bonded with melamine-formaldehyde, phenol-formaldehyde or phenol-furfural resins;
cross-linked polyester resins, cellulose triacetate films, polyethylene terephthalate films;
varnished polyethylene terephthalate textile bonded with oil-modified alkyd resin varnish;
enamels based on polyvinylformal, polyurethane or epoxy resins.

More extensive accelerated temperature tests and, in addition, compatibility testing is required for insulation systems of class B and higher temperature classes.

For totally enclosed motors the temperature rise limits for class A, class E and class B may be increased by 5 K.

A totally enclosed motor is a motor so constructed that the circulation of the air between the inside and the outside of the case is prevented but it is not necessarily sufficiently enclosed to be called airtight.

^c T signifies the maximum operating temperature.

For the purposes of this test, switches and thermostats marked with individual ratings may be considered as having no marking for the maximum operating temperature, if requested by the appliance manufacturer.

^d This limit applies to cables, cords and wires complying with BS 6500.

^e This limit applies to cables and flexible coads for use in high temperature areas that comply with BS 6141.

^f The values in parentheses apply if the material is used for handles, knobs, grips, etc. and it is in contact with hot metal.

^g There is no specific limit for thermoplastic material which has to withstand the tests specified in 30.1 or 30.2, for which purpose the temperature rise has to be determined.

^h The limit specified concerns the deterioration of wood and it does not take into account deterioration of surface finishes

13 Electrical insulation and leakage current at operating temperature

13.1 The electrical insulation of the appliance at operating temperature shall be adequate and the leakage current in normal use shall not be excessive.

TEST. Compliance shall be checked by the test specified in **13.2** and, for heating appliances, by the additional test specified in **13.3**, the appliance being operated in accordance with conditions of adequate heat discharge and/or under normal load for the time specified in **11.7**.

Heating appliances other than combined appliances shall be operated with all heating elements in circuit, the supply voltage being such that the input is 1.15 times the maximum rated input.

Motor-operated appliances and combined appliances shall be operated at a supply voltage equal to 1.06 times the rated voltage.

Three-phase appliances that are also suitable for single-phase supply shall be tested as single-phase appliances with the three sections connected in parallel.

The tests shall be carried out while the appliance is connected to the supply, except that for three-phase appliances not suitable for single-phase supply the test specified in **13.3** shall be carried out immediately after the appliance has been disconnected from the supply.

13.2 TEST. The leakage current shall be measured between any pole of the supply and the following:

- a) accessible metal parts and metal foil with an area not exceeding 200 mm × 100 mm in contact with accessible surfaces of insulating material, connected together;
- b) metal parts of class II appliances separated from live parts by basic insulation only.

The measuring circuit shall be as shown in the following figures:

- 1) for single-phase appliances having a rated voltage not exceeding 250 V, for three-phase appliances to be tested as single-phase appliances and for heating appliances for d.c. only:
 - i) if of class II, Figure 4;
 - ii) if other than class II, Figure 5.
- 2) For single-phase appliances having a rated voltage exceeding 250 V and for three-phase appliances not suitable for single-phase supply:
 - i) if of class II, Figure 6;
 - ii) if other than class II, Figure 7.

Single-phase appliances having rated voltage exceeding 250 V shall be connected to two of the phase conductors, the remaining phase conductor not being used.

The resistance of the measuring circuit shall be $2\,000 \pm 100\ \Omega$, and if it is suspected that high-frequency currents are being generated in a motor-operated appliance, the measuring instrument shall have an accuracy of at least 5 % for all frequencies within the range of 20 Hz to 5 000 Hz, but it shall be insensitive to higher frequencies.

The test shall be carried out with a.c., unless the appliance is for d.c. only, in which case the test shall be carried out with d.c. except that motor-operated appliances for d.c. only are not tested.

For single-phase appliances having a rated voltage not exceeding 250 V and for three-phase appliances to be tested as single-phase appliances, the leakage current shall be measured with the selector switch, shown in Figure 4 and Figure 5, in each of the positions 1 and 2.

For other appliances, the leakage current shall be measured with the switches a, b and c, shown in Figure 6 and Figure 7, closed; for three-phase appliances not suitable for single-phase supply, the measurements shall be repeated with each of the switches a, b and c open in turn, the other two switches being closed; for single-phase appliances, the measurements shall be repeated with one of the switches open.

After an operating time as specified in **11.7**, the leakage current shall not exceed the following values:

- | | |
|--|--|
| A) to accessible metal parts and metal foil: | |
| 1) for portable class I appliances | 0.75 mA |
| 2) for stationary class I motor-operated appliances | 3.5 mA |
| 3) for stationary class I heating appliances with heating elements that are detachable or can be switched off separately | 0.75 mA or 0.75 mA per kW rated input for each element or group of elements, whichever is the greater, with a maximum of 5 mA for the appliance as a whole |
| 4) for other stationary class I heating appliances | 0.75 mA or 0.75 mA per kW rated input of the appliance, whichever is the greater, with a maximum of 5 mA |
| 5) for class II appliances | 0.25 mA |
| 6) for class III appliances | 0.5 mA |

B) to metal parts of class II appliances separated from live parts by basic insulation only, if the appliance is classified according to degree of protection against moisture as:

- | | |
|----------------------------------|--------|
| 1) ordinary appliance | 5.0 mA |
| 2) other than ordinary appliance | 3.5 mA |

If the appliance incorporates one or more capacitors and is provided with a single-pole switch, the measurements shall be repeated with the switch in the "off" position.

For appliances incorporating both heating elements and motors, the total leakage current shall be within the limits specified for heating appliances or for motor-operated appliances, whichever is the greater, but the two limits shall not be added.

NOTE 1 The cut-off frequency of 5 000 Hz may, for example, be obtained by connecting a capacitor of 150 ± 7.5 nF in parallel with the resistive components of the measuring circuit. The measuring circuit may be partly or completely incorporated in the measuring instrument. If an instrument of the rectifier type is used, it should rectify linearly from 0.2 mA upwards within the frequency range of 20 Hz to 10 000 Hz, and should be calibrated in r.m.s. values with a current of substantially sine-wave form. If high-frequency voltages are not present, the cut-off frequency of the measuring instrument may exceed 5 000 Hz.

NOTE 2 It is recommended that the appliance be supplied through an isolating transformer; otherwise, it should be insulated from earth.

NOTE 3 The metal foil should have the largest area possible on the surface under test, without exceeding the dimensions specified. If its area is smaller than the surface under test, it should be moved so as to test all parts of the surface. However, it is essential that the heat dissipation of the appliance is not affected by the metal foil.

NOTE 4 The test with the switch in the "off" position is carried out to verify that capacitors connected behind a single-pole switch do not cause an excessive leakage current.

NOTE 5 If the appliance incorporates a thermal control which operates during the test of clause 11, the leakage current is measured immediately before the control opens the circuit.

13.3 TEST. The insulation other than that of motors shall be subjected for 1 min to voltage of substantially sine-wave form, having a frequency of 50 Hz to 60 Hz. For single-phase appliances and three-phase appliances to be tested as single-phase appliances, the connections shall be as shown in Figure 8.

The test voltage shall be applied between live parts and the body and, for class II appliances, between live parts and parts separated from live parts by basic insulation only. In addition, for class II appliances, the test voltage shall be applied between metal parts separated from live parts by basic insulation only and the body.

The value of the test voltage shall be as follows:

- 500 V for basic insulation subjected in normal use to a safety extra-low voltage;
- 1 000 V for other basic insulation;
- 2 750 V for supplementary insulation;
- 3 750 V for reinforced insulation.

Initially, not more than half the specified voltage shall be applied; then it shall be raised rapidly to the full value.

No flashover or breakdown shall occur during the test.

NOTE 1 Glow discharges without drop in voltage are ignored.

NOTE 2 The high voltage transformer used for the test should have a rating of at least 500 V.A.

NOTE 3 If the secondary winding of the isolating transformer is not provided with a tap at the midpoint, the output winding of the high-voltage transformer can be connected to the midpoint of a potentiometer having a total resistance not exceeding 2 000 Ω and connected across the output winding of the isolating transformer.

14 Radio and television interference suppression

14.1 The incorporation of components necessary to achieve an adequate degree of radio and television interference suppression shall not adversely affect the safety of the appliance.

TEST. Compliance shall be checked by the tests specified in this standard.

NOTE Compliance with the requirements concerning the limits for interference effects generated by the appliance, as specified in BS 800 and when measured in accordance with that standard, will in most cases ensure that the appliance has the required degree of radio and television interference suppression.

15 Moisture resistance

15.1 Drip proof, splash-proof and watertight constructions

The enclosure of drip-proof, splash-proof and watertight appliances shall provide the degree of protection against moisture in accordance with the classification of the appliance.

TEST. Compliance shall be checked by the appropriate treatment specified in 15.2, using the apparatus shown in Figure 9 to Figure 11.

Immediately after the appropriate treatment for drip-proof and splash-proof appliances, the appliance shall withstand the electric strength test specified in 16.4, and inspection shall show that water which may have entered the appliance does not impair compliance with this standard; in particular, there shall be no trace of water on insulation for which creepage distances are specified in 29.1.

Immediately after the treatment for watertight appliances, the appliance shall withstand the electric strength test specified in 16.4, with the exception of the test already made on the immersed appliance.

Appliances that are not subject to spillage of liquid in normal use shall be allowed to stand in normal test-room atmosphere for 24 h before being subjected to the test specified in 15.4.